United States Patent

[11] **3,633,833**

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[45] Patented **Jan. 11, 1972**

[54] **MACHINE WITH SELF-SHARPENING MEANS FOR CUTTING SCRAP MATERIALS INTO CHIPS**
7 Claims, 12 Drawing Figs.

[52] **U.S. Cl.** ..... **241/101 M,** 241/101 R, 241/194, 51/247
[51] **Int. Cl.** **B02c 23/00,** B02c 13/28, B24b 3/00
[50] **Field of Search** 241/101, 194; 51/246, 247, 248, 165.82; 56/250; 172/437; 76/85

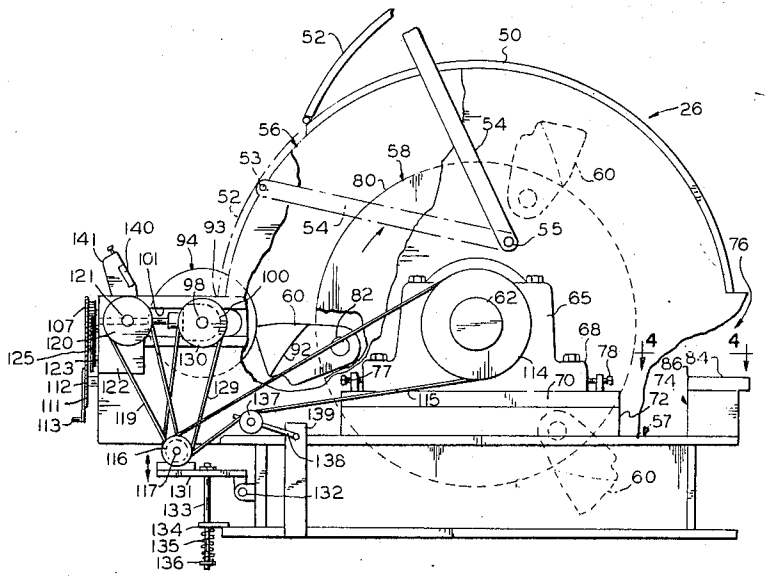
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ABSTRACT: The machine has a series of hammerlike knives which rotate about a common axis to cut scrap material fed across an anvil into small chips. In one embodiment, each knife has a massive head including a blunt front face with a V-shaped bottom cutting edge defining a pair of downwardly projecting prongs. In a second embodiment, the head of each knife has a V-shaped cutting edge defining a single downward projection. The cutting edge of both knife embodiments is straight as viewed in the cutting plane of the anvil. The bottom of the head just rearwardly of the cutting edge includes a pocket to trap and fragment by impact chips severed by the cutting edge. The cutting edges of all knives are sharpened at the same time as they rotate by a grinding cylinder which is fed either manually or automatically at a fixed rate into engagement with beveled forward faces of the knives. The grinding cylinder and its automatic feed are driven by the same means that drives the knives.



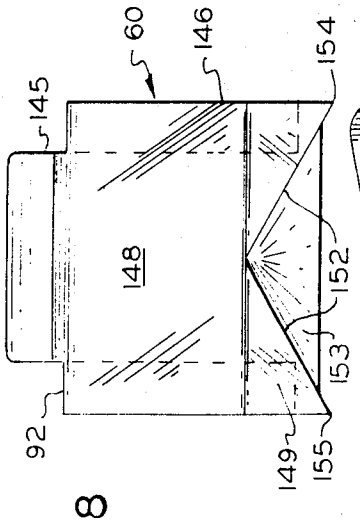


FIG. 8

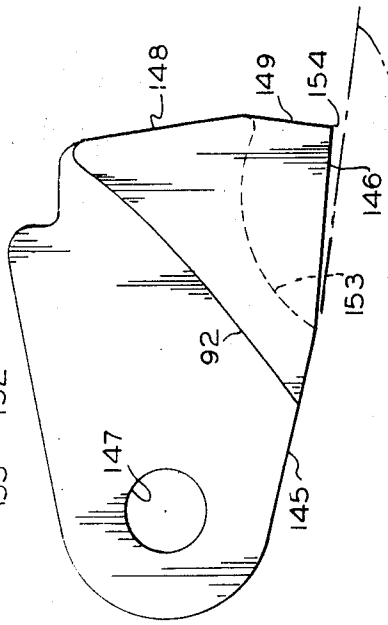


FIG. 9

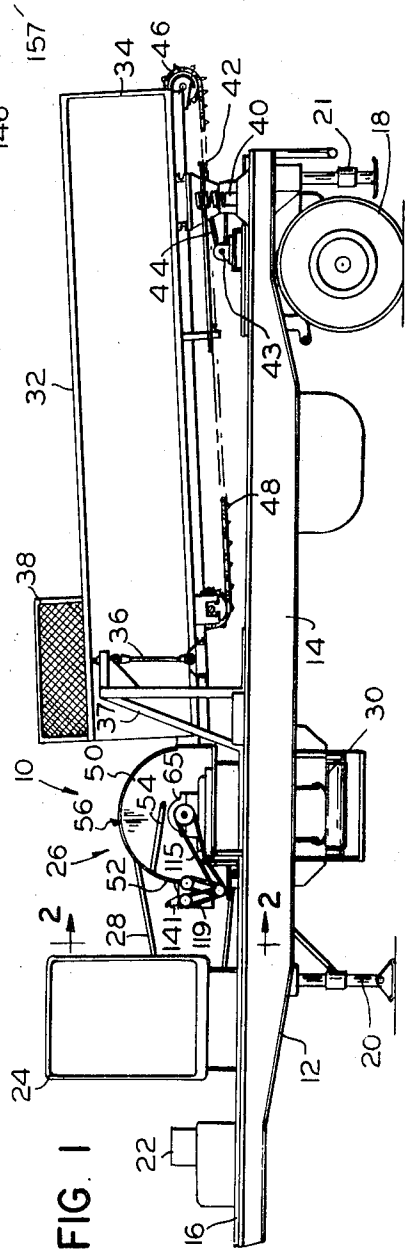


FIG. 1

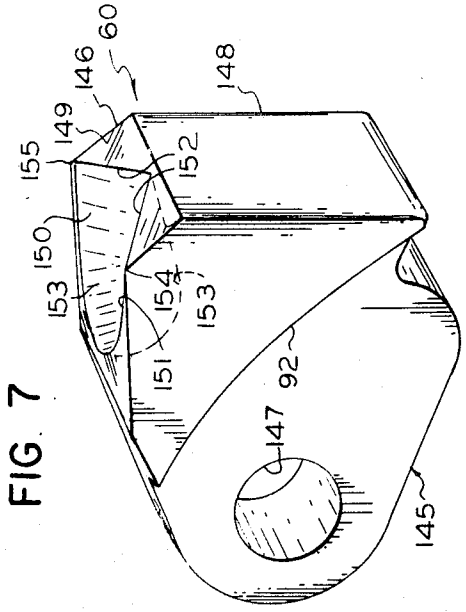


FIG. 7

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FIG. 2

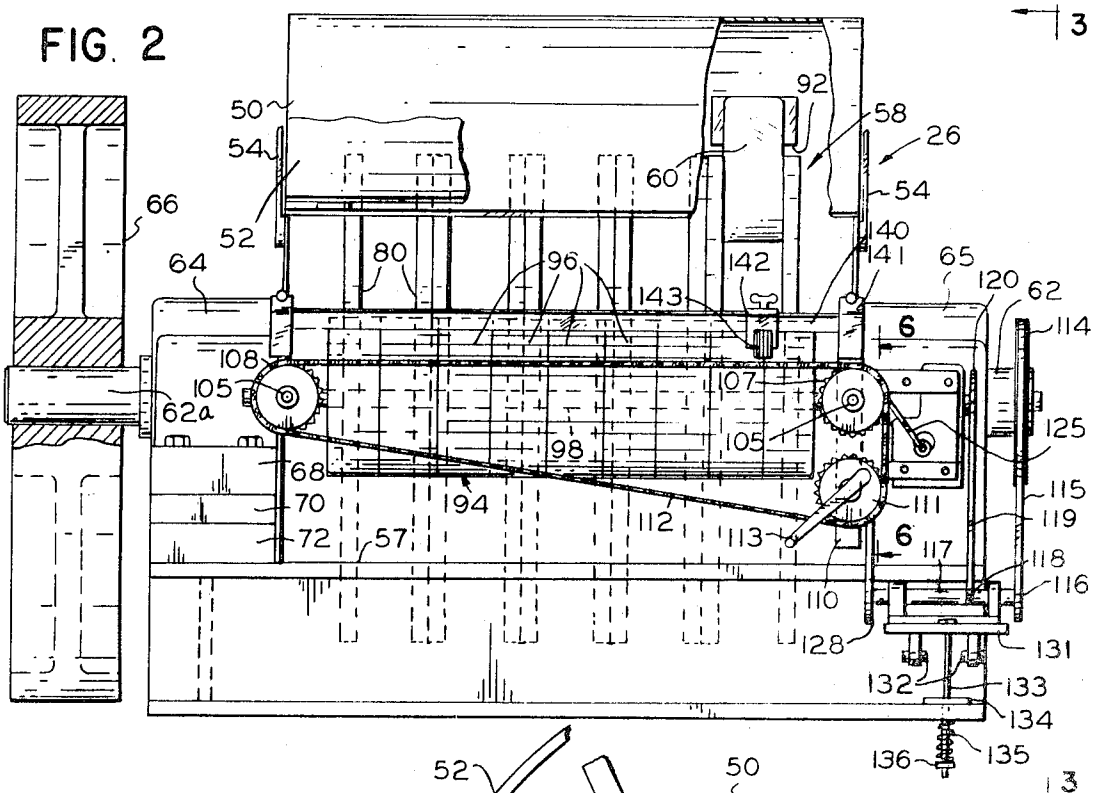
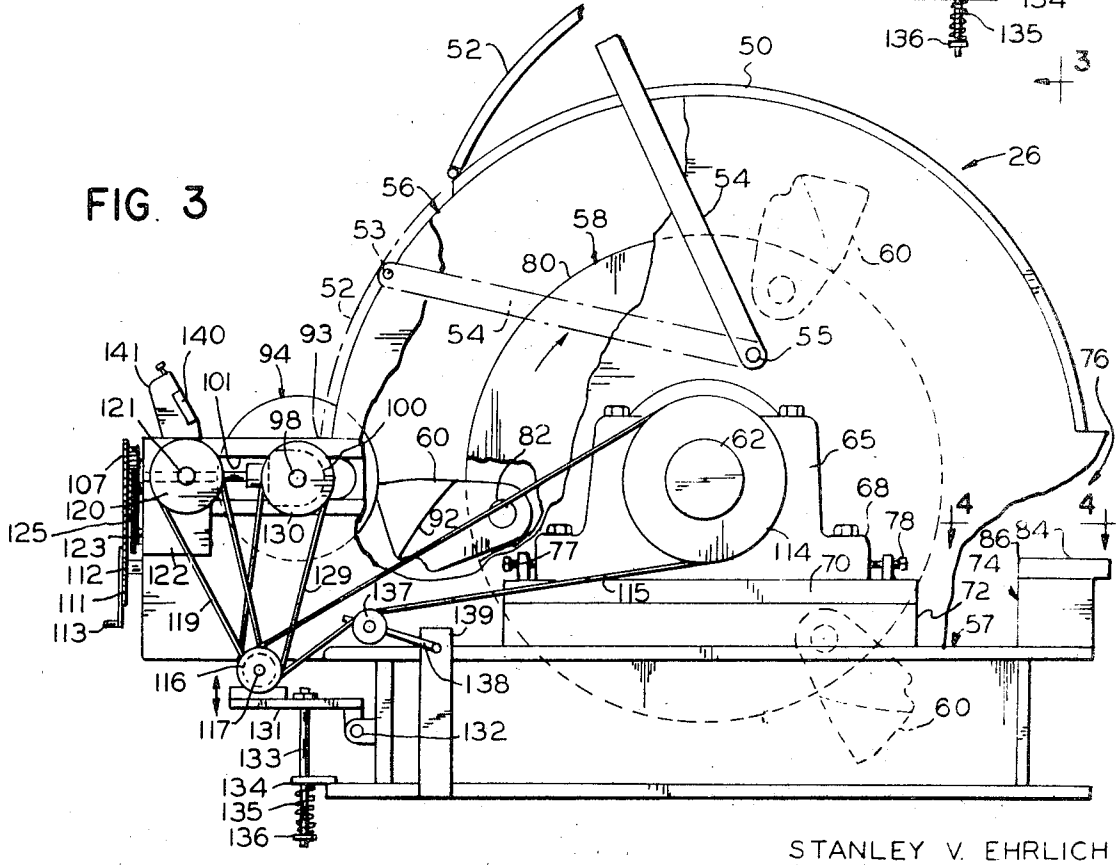


FIG. 3



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FIG. 4

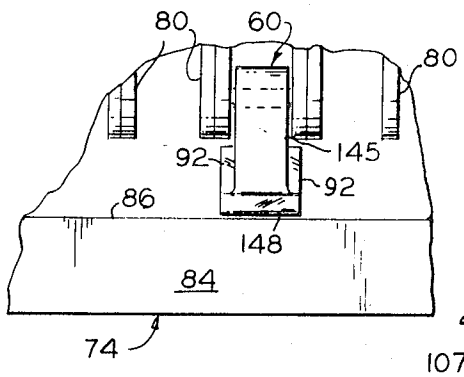


FIG. 5

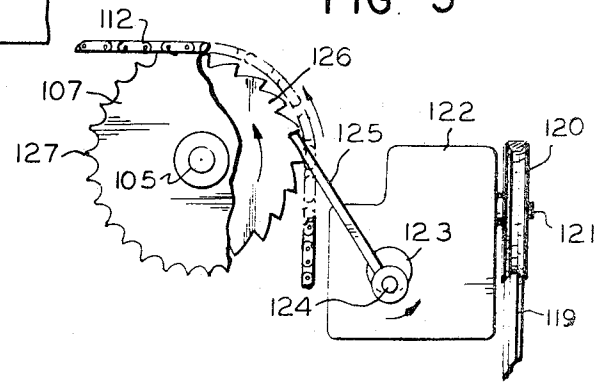
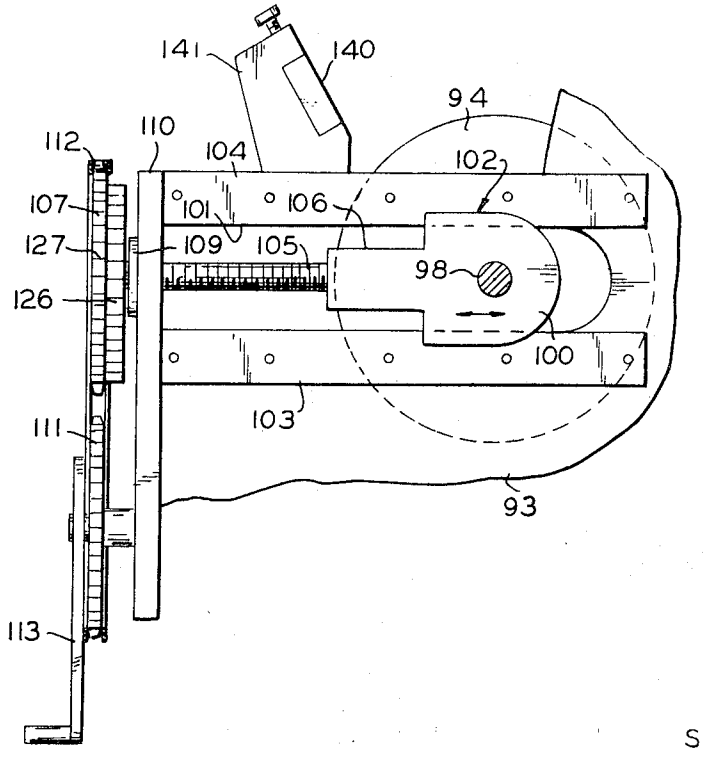


FIG. 6



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FIG. 10

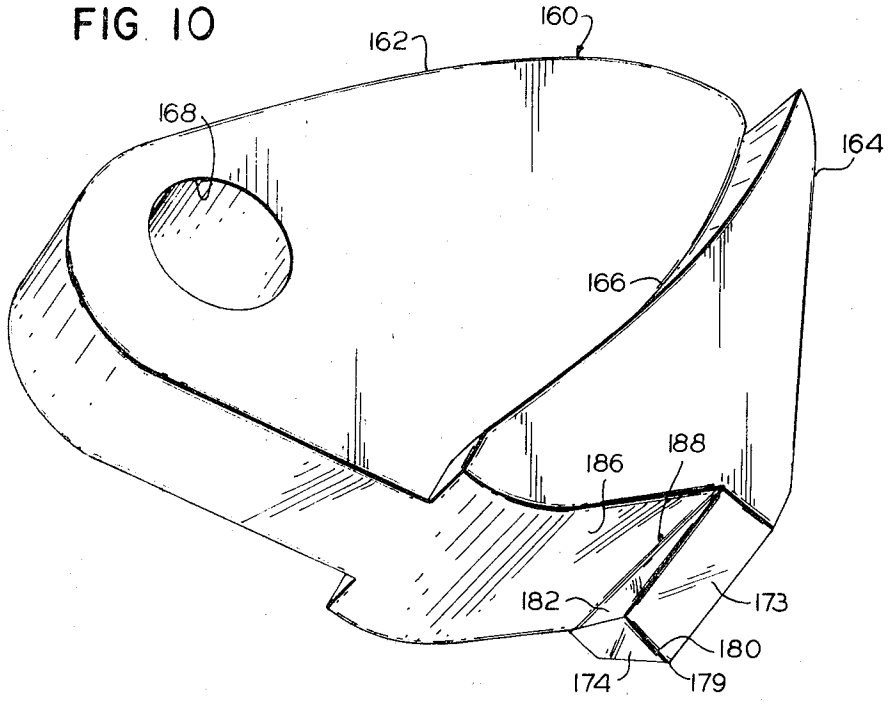


FIG. 11

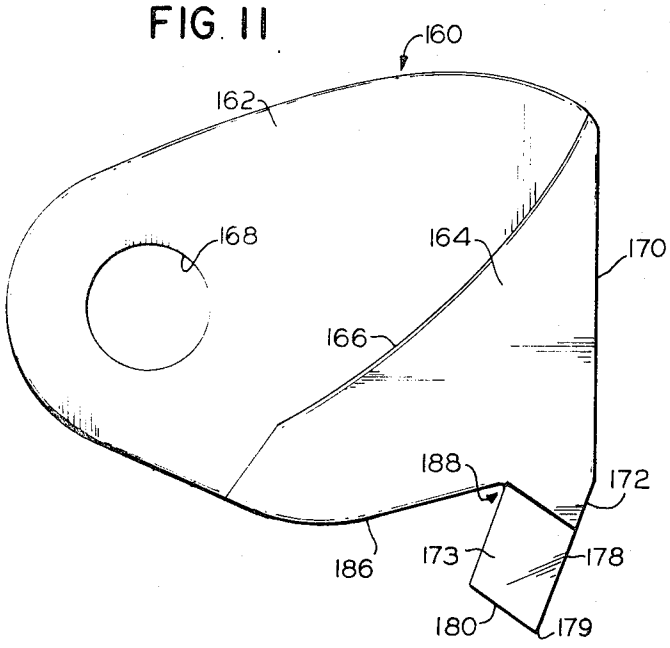
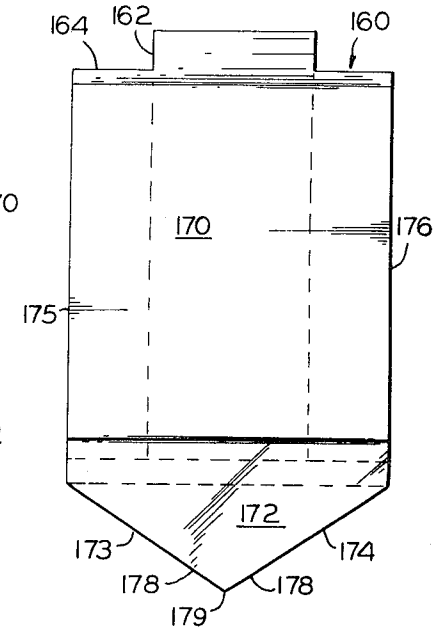


FIG. 12



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MACHINE WITH SELF-SHARPENING MEANS FOR CUTTING SCRAP MATERIALS INTO CHIPS

BACKGROUND OF THE INVENTION

Filed of the Invention

The present invention relates to apparatus for reducing bulk scrap materials such as railroad ties, scrap lumber, conduit, masonry and other materials commonly found in old buildings into small chips to increase the ease of disposing of such material.

2. Description of the Prior ARt

The only machine known that is capable of reducing by cutting scrap materials such as metals, masonry, aged lumber and other relatively hard and incompressible materials commonly found in old buildings being wrecked is described in my copending patent application, Ser. No. 711,658, filed Mar. 8, 1968, now U.S. Pat. No. 3,580,517 and entitled "Apparatus for Chipping Scrap Materials." The machine of the aforementioned application has been highly successful for its intended purpose. However, the hammerlike knives of such machine cannot readily be sharpened without shutting down the machine for substantial periods of time and painstakingly grinding each of the multitude of hammer knives individually, which, of course, is a long and tedious process.

Thus there is a need for a machine of this general type having cutting elements which can be readily self-sharpened by apparatus built into the machine, with a minimum of time loss and effort.

SUMMARY OF THE INVENTION

The present invention fulfills the foregoing need by providing a machine which fulfills the same general purpose as my prior machine, but with specially designed hammerlike knives which can be sharpened as they rotate through the use of a built-in rotating grinding wheel. Automatic means feed the wheel into grinding engagement with outer cutting surfaces of the knives at a predetermined rate to remove the desired amount of metal. Infeed and withdrawal of the wheel can also be accomplished manually. Means are also provided for adjusting the positioning of the cutting edges of the knives with respect to an anvil to compensate for the metal removed from the knives during the sharpening operation. A stone facing device for dressing the grinding wheel is also build into the machine.

The self-sharpening arrangement as described enables the cutting elements to be serviced while the machine remains at the job site and without losing any production time. The knives may be sharpened, for example, in a very short period of time following a day's work. Furthermore, with the device as described, the knives may be sharpened more frequently than would otherwise be the case whereby the knives are kept in top condition for cutting.

A specific feature of the invention is a hammer knife with a blunt forward face which defines a continuous straight cutting edge in the cutting plane of the knives, but which is V-shaped as viewed toward the front of the knife to define one or two downwardly projecting prongs for penetrating hard scrap materials.

Another feature is a pocket in the bottom of each knife just rearwardly of the cutting edge which receives chips of material severed by the knife and tends to explode these chips into even smaller fragments.

Further aspects of the invention are automatic feed and drive means for the sharpening mechanism which are driven by the power source that drives the knives.

In another aspect of the invention, the amount of metal removed from the knives during each sharpening operation can be accurately determined and controlled.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects and advantages of the present invention will become more apparent from the following detailed description which proceeds with reference to the accompanying drawings wherein:

FIG. 1 is a side elevational view of an overall machine in accordance with the invention;

FIG. 2 is an elevational view taken along the line 2—2 of FIG. 1;

FIG. 3 is an elevational view of the same portion of the machine as shown in FIG. 2 and taken along the line 3—3 of FIG. 2, with portions broken away for clarity;

FIG. 4 is a horizontal sectional view taken along the line 4—4 of FIG. 3;

FIG. 5 is an enlarged view of the automatic grinding wheel feed portion of FIG. 2 with supporting elements removed for clarity;

FIG. 6 is a view on an enlarged scale taken along the line 6—6 of FIG. 2;

FIG. 7 is a perspective view looking at the forward and lower surfaces of a hammer-knife in accordance with the invention;

FIG. 8 is a side view of the hammer knife of FIG. 5;

FIG. 9 is a front view of the hammer knife of FIG. 5;

FIG. 10 is a perspective view looking toward the bottom and one side of a modified hammer knife of the invention;

FIG. 11 is a side view of the hammer knife of FIG. 10; and

FIG. 12 is a front view of the hammer knife of FIG. 10.

DETAILED DESCRIPTION

General Arrangement

With reference to the drawings, a machine for chipping scrap materials of the invention is shown generally at 10 in FIG. 1. This machine includes a supporting trailer vehicle 12 having a frame portion 14 with a flat bed 16. The frame is supported on rear wheels 18 and telescoping front leg 20. Telescoping auxiliary rear legs 21 can be lowered into engagement with the ground for stabilizing the trailer during operation of the chipping apparatus. A hydraulic reservoir 22 is mounted at the forward end of bed 16. An internal combustion engine 24 mounted on the bed just rearwardly of the hydraulic reservoir drives the chipping apparatus 16 through a belt drive 28.

A belt conveyor 30 suspended from the underside of the trailer frame 14 extends laterally beneath the chipping apparatus 26. This conveyor receives chipping material discharged through a bottom opening of the chipping apparatus and conveys it to an awaiting carrier or pile alongside the trailer.

The portion of the trailer bed rearwardly of chipping apparatus 26 is occupied by a scrap-receiving bin 32 is mounted at a downward inclination from an open rear end 34 toward chipping apparatus 26. Support arms 36 support the front of the bin and are pivoted at their upper ends to support frames 37 to permit fore-and-aft oscillation of the bin. A protective screen 38 keeps material within the bin from riding up over its front end into the region of the chipping apparatus and engine.

The rear end of the bin is supported on coil springs 40. The rear end is also connected to an eccentric vibration device 42 driven by a hydraulic motor 43 through belt drive 44 to provide the rear portion of the bin with a rotary vibratory motion. This device is explained more fully in my aforesaid prior application, Ser. No. 711,658. Because of the mounting of the front of the bin in a way that does not permit vertical movement, the rotary motion at the rear of the bin is translated to forward-and-rearward oscillating motion which gradually feeds material into chipper unit 26 through a front end opening of the bin.

As a further aid to feeding materials from the bin toward chipping unit 26, a series of laterally spaced-apart endless drag chains 46 have upper flights which extend along the inside bottom of the bin throughout substantially its entire length. If desired, the chain may be provided with outwardly projecting lugs 48 which tend to grab the scrap material and thus aid in the dragging action of the chain.

A suitable rotatable ranking drum with radially extending tines (not shown) may be mounted within the front end of the bin near the entrance to the chipper unit if desired for aiding

and controlling the rate of feeding of material into the infeed opening of the chipper unit **26**. Such a rotary raking element is shown, for example, in FIGS. **1** and **2** of my aforementioned application, Ser. No. 711,658. When such a raking element is used, it has been found desirable to provide means for rotating the element in both directions so that the material being fed toward the chipping unit can be reversed if desired in the event of a Jam-up at the entrance to such unit.

Although the apparatus has been shown and described as mounted on a highway trailer vehicle, it is to be understood that the same basic components could be mounted on a railway flat car, as, for example, when the machine is to be used in disintegrating old railroad ties. Similarly, any other suitable vehicle may be used as a mounting means for the components of the apparatus. It may also be desirable in some instances to slope the receiving bin upwardly toward the chipping unit, as, for example, when loading materials from ground level. In such instances, it may be preferably to omit the vibrator.

Chipping Unit

For an understanding of the interior details of the scrap-chipping unit **26** of the apparatus, reference is made to FIGS. **2** through **6**, and to FIGS. **3**, **4**, and **5** of my aforementioned application, Ser. No. 711,658. The chipping unit of the present invention is similar in general arrangement to the chipping unit of my prior application with respect to the rotor construction and the pivotal mounting of the series of laterally adjacent hammerlike knife members between spaced plates fixed to the rotor shaft. Reference is made to my prior application for an understanding of such rotor and mounting details.

As shown in FIGS. **2** and **3**, chipping unit **26** includes a generally semicylindrical housing **50** having a curved cover plate **52** pivoted at **53** to a pair of supporting arms **54** which are adapted to swing about their connections **55** to opposite end walls of the housing to place the cover over a rear access opening **56** provided for servicing and inspection. The lower portion of the housing is rigidly mounted on I-beam base frame members **57** which in turn are fixed to the bed of the trailer.

A rotor means **58** mounting a series of hammer like knife members **60** is positioned within the housing and includes a large main driven shaft **62** which extends centrally through the interior of the housing and through its opposite end walls. Main shaft **62** is journaled near its opposite ends in bearing members **64**, **65**. An extension **62***a* of shaft **62** mounts a large pulley wheel **66** which transmits power from the engine **24** through belt **28** of FIG. **1**. Shaft-bearing members **64**, **65** include flange portions **68** fastened to shim plates **70**, **72** and to an upper portion of base frame member **57**. Plates **70** are readily removable for adjusting the vertical level of the rotor with respect to the base frame **56**, in order to adjust the cooperative cutting relationship between the knife members **60** and an anvil **74**. The anvil is mounted on the base frame at an infeed opening **76** of the chipping housing.

Setscrew adjusting means **77**, **78** on plates **70** enable horizontal adjustment of rotor **58** with respect to anvil **74** to compensate for metal removed from the hammer knives through the sharpening action removed from the hammer knives through the sharpening action of sharpening apparatus to be described.

As shown best in FIG. **2**, rotor **58** includes a series, in this instance 20, large-diameter discs **80** fixed to shaft **62** within housing **50** in laterally spaced-apart pairs. One disc of each pair abuts another disc of the next adjacent pair. Spacer sleeve members (not shown, but shown in the aforementioned prior application) are positioned on shaft **62** between the spaced discs to maintain the desired spacing.

Several, in this case three, hammer knives **60** are mounted on pivot pins **82** between each spaced pair of discs **80** near the outer periphery of such discs. Although the hammer knives between only one pair of discs is shown in FIGS. **2** and **3**, it is to be understood that there are an equal number of hammer knives between each of the other four pairs of discs. Furthermore, the hammer knives between each pair of discs are not aligned laterally with the hammer knives between the adjacent pairs of discs so as to minimize stress imposed on the rotor elements at any given time and to minimize vibration. The offset or staggered relationship between laterally related hammer knives is illustrated in the aforementioned pending application, Ser. No. 711,658.

From the foregoing it will be apparent that there are a total of 15 hammer knives with three being equally circumferentially spaced about each pair of discs so that a total of 15 hammer knives act on material fed across the anvil during each revolution of the rotor shaft **62**. Yet the hammer knives on laterally adjacent pairs of discs are staggered in such a manner that only one or two hammer knives act on the material at any given instant.

Anvil **74** includes a removable and rectangular upper plate **84** made of specially hardened material for long wear. Anvil plate **84** defines four laterally upstanding, straight cutting edges **86**, only one of which is operative at any given time. Plate **84** is symmetrical about longitudinal and lateral axes so that when one of the cutting edges **86** is worn, the plate may be reversed top-to-bottom and side-to-side so that eventually all four cutting edges **86** can be utilized.

The hammer knives are mounted for pivotal movement about axes parallel to the axis of the rotor to enable each knife to pivot rearwardly away from the anvil cutting edge and provide considerable clearance between the knife member and the anvil. This safety feature protects the machinery from damage should a knife strike an exceptionally hard object which is unable to penetrate as the rotor turns in a clockwise direction downwardly toward the anvil as shown in FIG. **3**. Each of the hammer knives is provided with laterally extending shoulder portions **92** which extend in overlapping relationship to the outer peripheries of discs **80**. These shoulders limit the amount of rearward pivoting movement of the knives, and thereby minimize the possibility of generating extraneous stresses and vibrations.

Frame members **57** also define a central discharge opening within housing **50** through which chipped scrap material cut by the hammer knives **60** passes in a downward direction toward discharge conveyor **30** beneath the trailer frame. Of course, bed **16** of the trailer itself must also be provided with a corresponding vertically aligned opening (not shown) to provide an unobstructed vertical passageway downwardly from within the rotor housing to the discharge conveyor.

Sharpening Apparatus

As shown in FIG. **3**, housing **50** includes rearward side extensions **93** between which a grinding cylinder **94** extends laterally through a length coextensive with the length of rotor **58**. The grinding cylinder is composed of a series of cylindrical grinding wheel segments **96** as shown in FIG. **2** fixed to a laterally extending shaft **98** suitable journaled at its opposite ends in bearing members **100**, one of which is shown in FIGS. **3** and **6**. Referring to FIG. **6**, each bearing member **100** forms part of a slide member **102** mounted for in-and-out sliding movement along horizontal guide bars **103**, **104** defining a horizontal slot **101** housing extension **93**. The bearing member **100** for the opposite end of shaft **98** is identical to the one shown and described and similarly forms part of another slide member (not shown) mounted in a similar manner in the opposite sidewall extension of the housing.

Both manual and automatic means are provided for moving grinding wheel **94** toward and away from the rotating knife members **60** through sliding movement of slides **102**. Referring to FIGS. **2**, **3** and **6**, these means include a pair of screw-threaded shafts **105**, one of which is threaded into a nut portion **106** of each slide member **102**. The outer ends of shafts **105** carry sprockets **107**, **108**. As shown in FIG. **6**, shaft **105** is rotatably mounted in a bearing member **109** on a supporting bar **110** which prevents axial movement of the shaft, thus rota-

tion of shaft 105 causes sliding movement of slide 102 and its supported grinding wheel 94.

Support bar 110 carries a second sprocket 111 below sprocket 107. The three sprockets 107, 108 and 111 are interconnected by an endless chain 112. Sprocket 111 mounts a crank handle 113 to facilitate rotation of such sprocket manually. Rotation of sprocket 111 induces simultaneous rotation of sprockets 107, 108 and their connected screw shafts 105 through chain 112, thereby sliding slides 102 and their supported grinding wheel 94 horizontally in or out as desired.

The automatic means for feeding grinding wheel 94 toward the hammer knives includes the sprockets 107, 108, chain 112, screw shafts 105 and rotor shaft 62 already mentioned, and a drive train for transmitting power from rotor shaft 62 to sprocket 107. Such drive train includes a pulley wheel 114 on shaft 62 transmitting power through a belt 115 to a smaller pulley 116 mounted on one end of a shaft 117. Shaft 117 includes a portion 118 of reduced diameter which receives a belt 119 for transmitting power to a pulley 120. Pulley 120 is mounted on the input shaft 121 of a speed-reducing gear box 122 having a large-diameter output shaft 123.

As shown in FIG. 5, shaft 123 has an eccentric portion 124 which pivotally mounts a pawl 125. Pawl 125 can be swung to a position shown wherein its outer end engages a ratchet-toothed section 126 of sprocket 107 also having the usual chain-engaging sprocket teeth 127. Thus when shaft 123 is driven at slow speed in a counterclockwise direction as viewed in FIG. 5 pawl 125 advances one ratchet tooth of sprocket 107 during each revolution of shaft 123. When considering the additional reduction provided by screw shafts 105, rotation of sprocket 107 in a counterclockwise direction through a distance of one ratchet tooth advances the grinding wheel through a very small predetermined distance. This feature makes it exceptionally easy to determine the amount of metal removed from the hammer knives by counting the number of ratchet teeth advanced by the pawl. To disengage the automatic feed, the pawl is simply swung out of engagement with the ratchet teeth 126 of sprocket 107.

Power for rotating grinding wheel 94 is also taken from rotor shaft 62 through the previously mentioned pulley 114, belt 115, pulley 116 and shaft 117. Shaft 117 carries a second pulley 128 as shown in FIG. 2 which transmits power through a belt 129 to a pulley 130 on the end of grinding wheel drive shaft 98.

To compensate for the variable positioning of shaft 98 as it moves in and out within slot 101, shaft 117 is journaled within bearing members on a platform 131 which is spring-biased against the tension of belt 129. Thus as grinding wheel shaft 94 moves in a direction tending to shorten the distance between pulley wheels 128 and 130, platform 131 pivots away from shaft 98, keeping belt 129 taut. Platform 131 is pivoted at 132 to base frame 57. The spring-biasing means for the platform includes a rod 133 anchored to a center portion of the platform and extending downwardly through a plate 134 fixed to frame 57. A coil spring 135 is compressed between plate 134 and an enlarged seat 136 near the lower end of rod 133, thereby tending to pivot platform 131 downwardly about its pivot connection 312 to the frame.

As platform 131 pivots up and down, there is a tendency to slacken and tighten drive belt 115 from the rotor shaft. To counter this tendency, an idler pulley 137 is mounted on an arm 138 which is spring-biased upwardly on a frame plate 139. Idler pulley 137 engages a lower portion of belt 115 and maintains constant upward pressure on such belt, thereby keeping belt 115 taut regardless of the position of platform 131.

Belt 119 also has a tendency to slacken and tighten as platform 131 pivots up and down. However, only a very light friction is required to rotate pulley 120. Therefore, belt 119 is made of a highly elastic material which maintains sufficient frictional engagement with pulley 120 to drive such pulley despite the variable positioning of platform 131.

Referring to FIGS. 2, 3 and 6, means are also provided for dressing grinding wheel 94 to keep it in good sharpening condition. Such means includes a slide bar 140 mounted at its opposite ends in brackets 141 on housing sidewall extensions 93. A tool holder 142 is mounted for sliding movement on slide bar 140. The tool holder supports a set of dressing tools 143. The surface of grinding wheel 94 can be retracted into engagement with the dressing tools by operation of crank 113.

Hammer knife Details

The hammer knives 60 are of a special design which enables them to be self-sharpened using grinding wheel 94. The design also makes the knives particularly effective in disintegrating chips severed by their cutting edges.

All of the hammer knives are identical in size and shape. Referring to FIGS. 7, 8 and 9, each includes a rear body portion 145 and an enlarged massive head portion 146 which extends laterally from the body portion and joins the body portion along the previously mentioned shoulders 92. Body portion 136 includes a through opening 147 extending from side to side of the knife member and of large enough diameter to receive pivot pin 82 and associated bushing member (not shown).

Head portion 146 includes a blunt flat frontal surface 148 which meets a lower forward cutting surface 149. Forward cutting surface 149 meets a pair of laterally inwardly and upwardly sloping bottom cutting surfaces 150, 151 at a lower front edge 152 defining the cutting edge of the hammer knife.

Sloping bottom surfaces 150, 151 also define a pocket 153 into which chips severed by cutting edge 152 are driven. The sloping nature of bottom surfaces 150, 151 also causes these surfaces together with forward cutting face 149 to define a pair of sharp projections 154, 155 as clearly shown in FIG. 9 at the lateral extremities of cutting edge 152. These projections increase the penetrating effect of the cutting edge as it strikes a piece of scrap material.

As viewed in a direction toward the front of the knife, cutting edge 152 is V-shaped sloping in a direction inwardly and upwardly toward the longitudinal median plane of the knife. However, as viewed in the cutting plane, or a plane 157 extending normal to the plane in which the forward cutting face 149 lies, cutting edge 152, or a projection of such edge, will define a straight line. The cutting plane 157 is also represented by the plane in which the top surface of anvil plate 84 and anvil cutting edge 86 lie. Thus, unlike the saw-tooth-type cutting edge provided on the anvil of the aforesaid prior application, Ser. No. 711,658, anvil cutting edge 86 is straight and therefore easier to manufacture and maintain than the former.

Upper front face 148 of the knife head extends at a rearward inclination with respect to the plane of lower forward cutting face 149 to provide clearance for the hammer knife as it proceeds downwardly past the anvil cutting edge. As viewed in FIG. 9, forward cutting face 149 extends at a forward inclination from cutting edge 152. On the other hand, front clearance face 148 extends at a rear ward inclination from its intersection with forward cutting face 149.

The beveled forward cutting face 149 in the face which is ground by grinding wheel 94 to maintain cutting edge 152 in a sharpened condition. Although grinding wheel 94, because of its cylindrical surface, will have a tendency to hollow-grind face 149, such tendency will be counteracted by the opposite curved path of travel of such face as it is ground. Thus beveled face 149 will be maintained in a very nearly flat condition as it recedes rearwardly through successive grinding operations. Each knife member will have a long life despite the fact that cutting face 149 and cutting edge 152 will gradually recede through subsequent grinding operations because of the great depth of the head as measured rearwardly from the forward cutting face.

Modified Hammer Knife

Referring to FIGS. 10, 11 and 12, a modified hammer knife 160 has a relatively thin main body portion 162 and an enlarged head portion 164 with a shoulder 166 separating the head from the body. Hammer knife 160 includes a rear opening 168 for receiving the pivot shaft of the rotor on which the hammer knife is adapted to be mounted.

Hammer knife 160 includes an upper front face portion 170 which meets a lower, rearwardly inclined front cutting face portion 172. Lower front face 172 meets a pair of side surfaces 173, 174 which angle inwardly and downwardly from opposite sidewalls 175, 176 of the head to define a generally V-shaped cutting edge 178 terminating at a single point 179.

The intersection of surfaces 173 and 174 extends rearwardly from the point 179 to define a bottom edge 180 of a single prong 182 formed by the surfaces just described. Prong 182 extends below an adjacent bottom surface 186 of the head to define a pocket 188 in the region just behind the prong. Chunks of material severed by the hammer knife are driven into this pocket and thus disintegrated into smaller particles. In this respect the hammer knife has an action similar to the two-pronged version of the hammer knife shown in FIG. 5.

Like the previously described double-pronged hammer knife, hammer knife 160 has the ability to be self-sharpened using the apparatus that is shown in FIG. 3. In this regard cutting face 172 is periodically reground to maintain the forward cutting edges 178 in a sharpened condition.

Operation

During normal operation of the apparatus to disintegrate scrap material, the rotor as viewed in FIG. 3 is rotated in a clockwise direction as bin 32 is vibrated and drag chains 46 rotate to feed material at a desired rate into the chipper housing and across the anvil. For example, the rate of feed of material onto the anvil can be adjusted so that the knife members take a one-quarter to one-third inch bite with each impact-shear stroke, which is normal operating speeds would destroy scrap material at a rate of 36 running feet per minute.

As each hammer knife passes in shearing relationship to the cutting edge of the anvil, the two points 154, 155 of each knife cutting edge readily penetrate scrap material to sever chips and drive these chips into pocket 153. The pocket first tends to compress the chips and finally explodes them into even smaller fragments as a result of the high impact forces generated. The downwardly rotating knives also drive the resulting scrap fragment downwardly through the bottom discharge opening of the chipper housing and onto discharge conveyor 30. This conveyor then transfers the material to one side of the machine, and, if desired, to an elevating conveyor (not shown) which dumps the scrap chips into a waiting truck or other carrier.

At the end of a day's work, the condition of the cutting edges of the hammer knifes is inspected simply by raising access cover 52. If sharpening is indicated, the operator first determines how much metal should be removed to resharpen the cutting edges of the knives. Then he rotates crank 113 in a direction to advance grinding wheel 94 into the housing until its grinding surface is positioned adjacent the forward cutting faces 149 of the knife members. Thereafter the operator starts up engine 24 to drive the rotor and attached knives. He also engages the automatic feed by swinging pawl 125 into contact with ratchet teeth 126 of sprocket 107. Thus power is transmitted by rotor shaft 62 through belt and pulley drive train described in rotate grinding wheel 94 clockwise and simultaneously advance the wheel into engagement with the forward cutting faces of the rotating knives at a predetermined rate. This rate is based on the known speed ratio between rotor shaft 62 and output shaft 123 of gear reducer 122. For example, in one embodiment, 0.003 of an inch of metal is removed from each knife for every 6,000 revolutions of the rotor shaft. A counter can be mounted on a control panel if desired to keep track of the number of shaft revolutions and thus accurately control the amount of metal removed during each sharpening operation. Alternatively the amount of metal removed can be determined in terms of the number of ratchet teeth advanced on sprocket 107. The operator can readily keep track of ratchet tooth movement usually and shut down the machine when the required number of teeth have been advanced by the pawl.

Following the grinding operation, grinding wheel 94 is withdrawn by disengaging pawl 125 from sprocket 107 and manually cranking sprocket 111 in the required direction. Thereafter it might be necessary to reposition the rotor with respect to the anvil, depending on how much material has been removed from the hammer knives. For example, if the total of one-sixteenth of an inch is removed from the forward cutting face of each knife, it is necessary to shift the axis of rotor shaft 62 toward the anvil a corresponding distance by adjustment of setscrews 77, 78.

Having illustrated the principles of my inventions in what are presently preferred embodiments, it should be apparent that such embodiments permit of modification in arrangement and detail. It is my intention not to be limited by the specific embodiments disclosed, but to include within the scope of my invention all such modifications and equivalent constructions.

I claim:

1. In an apparatus for cutting scrap materials into small chips:

anvil means defining a stationary cutting edge,

means for feeding scrap material across said anvil means and over said cutting edge,

rotor means pivotally mounting a plurality of laterally related hammerlike knife members for pivoting movement about pivot axes parallel to and SPACED equal distances from a common rotor axis extending in the general direction of said anvil cutting edge in a manner so that each said knife member rotates into periodic cutting relationship with said anvil cutting edge,

each of said knife members including a knife cutting edge defined by a forward cutting face and a bottom cutting face thereof,

and sharpening means movable into engagement with said forward cutting faces of said knife members as said knife members rotate to sharpen said knife cutting edges,

said sharpening means including a cylindrical grinding wheel having a length substantially coextensive with the lateral extent of said plurality of knife members, and rotatable in the same direction as said knife members,

self-feeding means for feeding said grinding wheel toward said knife members at a predetermined slow rate of travel, and manually operated override means for moving said grinding wheel toward and away from said knife members at a fast rate of travel.

2. Apparatus according to claim 1 wherein said self-feeding means and said manual override means include screw means operable upon rotation to move said grinding wheel toward and away from said knife members, and said self-feeding means further including drive means for rotating said screw means drivingly connected to means for rotating said knife members, said drive means including speed-reducing means, and eccentric means driving a pawl and ratchet means whereby said screw means is rotated at a predetermined slower speed than said knife members and the amount of metal removed from said knife members can be determined by counting strokes of said ratchet and pawl means, and clutch means for selectively disengaging said drive means.

3. Apparatus according to claim 2 wherein said means for rotating said grinding wheel means includes second drive means drivingly connected to said means for rotating said knife members, said second drive means including automatic adjustment means operable to compensate for the varying distance between the rotational axis of said wheel means and the rotational axis of said knife members to provide a continuous drive therebetween.

4. Apparatus according to claim 2 wherein said manual override means includes means for manually rotating said screw means with said clutch means disengaged.

5. Apparatus according to claim 1 wherein said knife cutting edge is V-shaped as viewed toward the front of said knife member so as to define a pair of pointed projections at the laterally opposite extremities of said knife cutting edge.

6. Apparatus according to claim 5 wherein each knife member includes a bottom surface intersecting said forward cutting face to define said knife cutting edge, said bottom surface being recessed rearwardly of said knife cutting edge and recessed laterally inwardly of opposite lower side edges of said knife member to define a pocket for receiving material severed by said knife cutting edge.

7. Apparatus according to claim 1 wherein each said knife member includes a bottom surface portion intersecting said forward cutting face at a V-shaped knife cutting edge, said V-shaped knife cutting edge forming a downward pointed projection for penetrating, crushing and severing material and forming forward end of a pocket defined by said bottom surface portion for trapping and fragmenting by impact material severed by said projection.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,633,833 Dated January 11, 1972

Inventor(s) STANLEY V. EHRLICH

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below: Column 1, line 5, "Filed" should be --Field--; Column 1, line 1 "ARt" should be --Art--; Column 1, line 44, "build" should be --built--; Column 2, line 39, "16" should be --26--; Column 2, line 43, "chipping" should be --chipped--; Column 2, line 48, after "bin 32" the following has been omitted: --. Bin 32--; Column 2, line 56; "vibration" should be --vibrator--; Column 2 line 73, "ranking" should be --raking--; Column 3, line 8, "Jam-up" should be --jam-up--; Column 3, line 19, "preferably" should be --preferable--; Column 3, line 57, "chipping" should be --chipper--; Column 3, lines 61-62, the phrase "removed from the hammer knives through the sharpening action" has been dupli cated; Column 3, line 65, "20" should be --ten--; Column 4, line 57, "suitable" should be --suitably--; Column 5, line 46, "the" should be --an--; Column 5, line 62, "312" should be --132--; Column 6, line 60, "rear ward" should be --rearward--; Column 6, line 62, "in" should be --is--; Column 6, line 67, "opposite" should be --oppositely--; Column 7, line 39, "is" should be --at--; Column 7, line 48, "fragment" should be --fragments--; Column 7, line 67, "in" should be --to--; Column 8, line 5, "usually" should be --visually--; Column 8, line 33, claim 1, "SPACED" should be --spaced--; Column 9, line 6, claim 5, after "pointed" the word --downward-- was omitted; Column 10, line 8, claim 7, after "forming" the word --the-- was omitted.

Signed and sealed this 22nd day of August 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR. ROBERT GOTTSCHALK
Attesting Officer Commissioner of Patent

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